

WHAT IS CLAIMED IS:

1. A pattern inspection apparatus to inspect pattern defects of a substrate in which a pattern is formed comprising:

5           an illumination optics which applies a first inspection light on a predetermined wavelength to a surface opposite to a pattern formed surface of the substrate, and applies a second inspection light whose wavelength is equal to the predetermined wavelength  
10          of the first inspection light to the pattern formed surface;

          a detector which selectively detects a transmitted light from the substrate by irradiation of the first inspection light and a reflected light from the  
15          substrate by irradiation of the second inspection light so as to perform a transmitted-light-based inspection and a reflected-light-based inspection; and

          a space separation mechanism which is provided in the vicinity of an optical focal plane toward the  
20          pattern formed surface of the substrate, and spatially separates an irradiation area of the first and the second inspection light such that the transmitted light and the reflected light from the substrate are imaged in two discrete areas separated on the optical focal  
25          plane.

2. The pattern inspection apparatus according to claim 1, further comprising: a first detection optics

which leads the transmitted light separated by the  
space separation mechanism to the detector; and a  
second detection optics which leads the reflected light  
separated by the space separation mechanism to the  
5 detector.

3. The pattern inspection apparatus according  
to claim 2, wherein the first detection optics and  
the second detection optics independently change a  
magnification for an observed image, and change an  
10 illumination area of the illumination optics in  
accordance with the magnification thereof, respec-  
tively.

4. The pattern inspection apparatus according  
to claim 1, wherein the illumination optics has a  
15 polarizing beam splitter provided between the pattern  
formed surface of the substrate and the space  
separation mechanism, and the polarizing beam splitter  
reflects the second inspection light to lead the second  
inspection light to the pattern formed surface of the  
20 substrate, and lets the transmitted light and the  
reflected light from the substrate pass through.

5. The pattern inspection apparatus according  
to claim 1, wherein the illumination optics has a  
polarizing beam splitter provided between the space  
25 separation mechanism and the detector, and the  
polarizing beam splitter transmits or reflects the  
second inspection light to lead the second inspection

light to the space separation mechanism, and reflects or lets through the reflected light from the substrate obtained via the space separation mechanism to lead the reflected light to the detector.

5           6. The pattern inspection apparatus according to claim 1, wherein the optical focal plane toward the pattern formed surface of the substrate is at least a magnification focal plane of an observation field observed in the pattern formed surface, and a mirror is  
10           used as the space separation mechanism, and the mirror is fixed at a position offset from the optical focal plane.

          7. The pattern inspection apparatus according to claim 1, further comprising an XY stage on which  
15           the substrate is mounted, and which moves in an XY direction of a plane vertical to an illumination light axis, wherein one axis of the XY stage is sequentially moved to obtain a pattern image, and a TDI sensor of a charge accumulation type is used as a detection sensor  
20           of the detector, and the number of accumulation steps of the TDI sensor for the transmitted-light-based inspection is different from that of the accumulation steps of the TDI sensor for the reflected-light-based inspection.

25           8. The pattern inspection apparatus according to claim 1, wherein the illumination optics has a single light source.

9. A pattern inspection apparatus to inspect pattern defects of a substrate in which a pattern is formed comprising:

5 a first illumination optics which applies a first inspection light on a predetermined wavelength to a surface opposite to a pattern formed surface of the substrate;

10 a first detection sensor which detects a transmitted light from the substrate by irradiation of the first inspection light, for a transmitted-light-based inspection;

15 a second illumination optics which applies a second inspection light whose wavelength is equal to the predetermined wavelength of the first inspection light to the pattern formed surface of the substrate;

a second detection sensor which detects a reflected light from the substrate by irradiation of the second inspection light, for a reflected-light-based inspection; and

20 a space separation mechanism which is provided in the vicinity of an optical focal plane between the pattern formed surface of the substrate and the first and the second detection sensor, and separates the transmitted light and the reflected light from the substrate such that the transmitted light and the  
25 reflected light are imaged in two discrete areas separated on the optical focal plane.

10. The pattern inspection apparatus according to claim 9, further comprising: a first detection optics which leads the transmitted light separated by the space separation mechanism to the first detection sensor; and a second detection optics which leads the reflected light separated by the space separation mechanism to the second detection sensor.

11. The pattern inspection apparatus according to claim 10, wherein the first detection optics and the second detection optics independently change a magnification for an observed image, and change illumination areas of the first illumination optics and the second illumination optics in accordance with the magnification thereof, respectively.

12. The pattern inspection apparatus according to claim 9, wherein the second illumination optics has a polarizing beam splitter provided between the pattern formed surface of the substrate and the space separation mechanism, and the polarizing beam splitter reflects the second inspection light to lead the second inspection light to the pattern formed surface of the substrate, and lets the transmitted light and the reflected light from the substrate pass through.

13. The pattern inspection apparatus according to claim 9, wherein the second illumination optics has a polarizing beam splitter provided between the space separation mechanism and the second detection sensor,

and the polarizing beam splitter transmits or reflects the second inspection light to lead the second inspection light to the space separation mechanism, and reflects or lets through the reflected light from the substrate obtained via the space separation mechanism to lead the reflected light to the second detection sensor.

14. The pattern inspection apparatus according to claim 9, wherein the optical focal plane toward the pattern formed surface of the substrate is at least a magnification focal plane of an observation field observed in the pattern formed surface, and a mirror is used as the space separation mechanism, and the mirror is fixed at a position offset from the optical focal plane.

15. The pattern inspection apparatus according to claim 9, further comprising an XY stage on which the substrate is mounted, and which moves in an XY direction of a plane vertical to an illumination light axis; wherein one axis of the XY stage is sequentially moved to obtain a pattern image, and TDI sensors of a charge accumulation type are used as the first and the second detection sensor, and the number of accumulation steps of the TDI sensor for the transmitted-light-based inspection is different from that of the accumulation steps of the TDI sensor for the reflected-light-based inspection.

16. The pattern inspection apparatus according to claim 9, wherein the first and the second illumination optics share a single light source.

17. A pattern inspection apparatus to inspect  
5 pattern defects of a substrate in which a pattern is formed comprising:

a first illumination optics which applies a first inspection light on a predetermined wavelength to a first area of a pattern formed surface of the  
10 substrate;

a first detection sensor which detects a transmitted light from the substrate by irradiation of the first inspection light;

a second illumination optics which applies a  
15 second inspection light whose wavelength is equal to the predetermined wavelength of the first inspection light and whose polarizing direction is different from that of the first inspection light, to a second area, which is separated from the first area, of the pattern  
20 formed surface of the substrate;

a second detection sensor which detects a reflected light from the substrate by irradiation of the second inspection light; and

a polarizing beam splitter which is provided in  
25 the vicinity of an optical focal plane between the pattern formed surface of the substrate and the second detection sensor, and reflects or transmits the first

and the second inspection light to send to the pattern formed surface of the substrate, and transmits or reflects the reflected light from the substrate to send to the second detection sensor.

5           18. The pattern inspection apparatus according to claim 17, further comprising: a first detection optics which leads the transmitted light to the first detection sensor; and a second detection optics which leads the reflected light to the second detection  
10 sensor.

          19. The pattern inspection apparatus according to claim 18, wherein the first detection optics and the second detection optics independently change a magnification for an observed image, and change  
15 illumination fields of the first illumination optics and the second illumination optics in accordance with the magnification thereof, respectively.

          20. The pattern inspection apparatus according to claim 17, further comprising an XY stage on which  
20 the substrate is mounted, and which moves in an XY direction of a plane vertical to an illumination light axis; wherein one axis of the XY stage is sequentially moved to obtain a pattern image, and TDI sensors of a charge accumulation type are used as the first and the  
25 second detection sensor, and the number of accumulation steps of the TDI sensor for the transmitted-light-based inspection is different from that of the accumulation



steps of the TDI sensor for the reflected-light-based inspection.

21. The pattern inspection apparatus according to claim 17, wherein the first and the second illumination  
5 optics share a single light source.